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REMEDIAL ACTION CONCEPT PAPER FOR THE URANIUM MILL TAILINGS SITE AT SHIPROCK, NEW MEXICO

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1. INTRODUCTION

In November 1978, Congress enacted Public Law 95-604, the "Uranium Mill Tailings Radiation Control Act of 1978" (UMTRCA). Title 1 of the Act authorizes the Department of Energy (DOE) to enter into cooperative agreements with the affected states and Indian tribes in order to establish assessment and remedial action programs at inactive uranium mill tailings sites. The Act stipulates that in performing remedial actions the DOE will meet the applicable radiation standards promulgated by the Environmental Protection Agency (EPA). It further states that the Nuclear Regulatory Commission (NRC) is to concur in all major decisions and to license the maintenance and monitoring of the final disposal sites. The DOE is to provide 90 percent of the remedial action costs, with the affected states to pay the remaining costs. For those sites on Indian lands, 100 percent of the costs for remedial action will be borne by the Federal government.

Twenty-four sites, including one on the Navajo Indian Reservation at Shiprock, New Mexico, have been designated as eligible for remedial action. A cooperative agreement covering the guidelines, responsibilities, and conditions for remedial actions at Shiprock is being negotiated between the DOE and the Navajo Nation. It will enter into effect upon their agreement and upon concurrence by the U.S. Nuclear Regulatory Commission.

The remedial actions for the Shiprock site will be managed by the DOE through the Uranium Mill Tailings Remedial Actions (UMTRA) Project Office, Albuquerque, New Mexico, in consultation with the Navajo Environmental Protection Commission and with the concurrence of the NRC in certain major decisions.

The purpose of this Remedial Action Concept Paper (RACP) is to identify reasonable alternatives for remedial action, to discuss the significant factors influencing the decision as to what remedial actions will be taken, and to describe the remedial action concept that now appears preferable.

The publication of this RACP does not mean a decision or commitment concerning specific actions has been made. Such decisions can be made only after the requirements of the National Environmental Policy Act (NEPA) have en met and definitive plans supported by engineering studies have been formulated and evaluated. However, since the RACP does set limits about the ultimate decision on remedial action, it serves as a document that provides a conceptual basis for the preparation of the environmental documentation required by NEPA.

This RACP has been prepared by the DOE UMTRA Project Office with the agreement of the Environmental Protection Commission of the Navajo Nation and the concurrence of the U.S. Nuclear Regulatory Commission. A final remedial action plan will be prepared after the NEPA process is complete.

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2. SITE DESCRIPTION

The Shiprock site (Figures 1, 2, and 3) is located on a 75-foot high bluff on the west side of the San Juan River overlooking the community of Shiprock, New Mexico. It is in the northwest corner of New Mexico about 30 miles west of Farmington and is on the Navajo Indian Reservation. The site contains 143.6 acres, of which about 72 acres are covered with tailings. The tailings are in two adjoining piles, an upper or north pile adjacent to the bluff, and a lower or south pile.

The tailings rest on a 10 to 20-foot layer of terrace gravel that is underlain by Mancos Shale. The site is in an extensive area of plains and rangeland. Dominant terrain features in the immediate vicinity are the San Juan River and its floodplain. Erosion associated with washes leading to the river is widespread. The climate is semi-arid with precipitation averaging less than 8 inches per year.

The former Navajo Mill at the Shiprock site was designed and built by Kerr-McGee Oil Industries, Inc., on a 230-acre tract* leased from the Navajo Nation. Kerr-McGee operated the mill from 1954 until 1963, when it was purchased by the Vanadium Corporation of America (VCA). The VCA, which was later merged into Foote Mineral Company, continued operations until 1968. Upon expiration of the lease in 1973, ownership of the site reverted to the Navajo Nation. The mill processed a total of about 1.5 million short tons of ore along with smaller quantities of bulk precipitates from heap leach operations, stockpiled sand tailings (both from the Monument Valley area), and purchased vanadium liquor. A two-stage sulfuric acid leaching circuit, countercurrent washing circuit, and uranium and vanadium solvent extraction circuits were used. Tailings from the washing circuit and yellow cake filtrates were pumped to the tailings disposal areas, while raffinate from the solvent extraction circuits was allowed to evaporate in separate holding ponds.

After the site reverted to the Navajo Nation a portion of the area was occupied by the Navajo Engineering and Construction Authority (NECA). The NECA established a training school for heavy equipment operators and used the lower tailings pile as a practice ground. This resulted in enlargement of the pile and spreading of the tailings over most of the former holding pond area. In April 1974 a radiation survey was conducted at the site by the EPA. They noted that the training activities were adversely affecting radiological conditions and recommended that the training activities be redirected toward decontamination of the site and interim stabilization of the tailings. This recommendation was accepted and these actions were carried out from then until mid-1978 with guidance and support from the EPA. The EPA guideline for off-pile decontamination was to reduce

*Not all the tract was used; therefore only 143.6 acres have been designated as the Shiprock site eligible for remedial action.

the net above-ground exposure rate to less than 10 microroentgen per hour above background. The site was divided into six areas as shown in Figure 4. Surface contamination, i.e. contamination less than three feet deep, was found in all areas and was removed to the tailings pile. In Area A, contamination ten feet or more in depth was found near the pile boundary with the deepest contamination occurring in the wash leading to the river. Only surface contamination was found in Area B. There was a contaminated seepage channel about six feet deep in Area C. Area D contained the mill buildings. Contamination, in some cases several feet deep, was unearthed from around and under the buildings. The main mill building was completely dismantled and those parts of it such as the roof that were too contaminated to be salvaged were buried in the pile area. Other buildings were cleaned using water hoses. Area E, where holding ponds had been located, was excavated down to a sandstone cap on top of the Mancos Shale and then filled with dirt brought from a borrow pit located southeast of the site. Area F had been the ore storage area and had also been the site of heavy equipment training exercises. Contamination over three feet in depth was common, and in the mill drain and the wash extended to ten feet or so. All contaminated materials and soils were removed to the tailings piles. The soils were used as a cover to stabilize the lower pile. The upper pile has a stabilizing cover of about a foot of soil and gravel.

The NECA still occupies the site and has a new office building and maintenance shop; however, training activities are no longer conducted there. The U. S. Public Health Service now leases the former mill office building.

It is probable that there are properties in the vicinity of the Shiprock site that have been contaminated with residual radioactive materials derived from the site. An EPA ground survey in 1972 and a DOE aerial survey in 1980 indicated the existence of about a dozen vicinity properties with radiation exposure rates above local background levels. A DOE ground survey will be conducted to determine which properties should be cleaned up.

3. REMEDIAL ACTION OBJECTIVES

The mission of the UMTRA Project at Shiprock is to carry out a cleanup program according to EPA standards for the disposal of tailings and for the cleanup of open lands and structures. The interim and proposed standards are summarized and discussed in Section 4. Final standards are expected to be issued by January 1983. All residual radioactive materials, contaminated soils, and other contaminated materials from the Shiprock site and eligible vicinity properties will be stabilized at one location. The disposal site will be controlled by the Federal government and licensed by the NRC. All presently contaminated areas, other than those that may be part of the final disposal site, will be cleaned up well enough to be released for unrestricted use.

4. STANDARDS, LICENSING, AND EVALUATION FACTORS

4.1 EPA Standards

Under Public Law 95-604, no remedial action may begin until final cleanup standards have been promulgated. The final standards have not yet been issued. However, in order to permit cleanup to begin at contaminated vicinity properties, the EPA has issued interim standards (45 FR 27366-27368, April 22, 1980) for the cleanup of open lands and structures in which elevated radiation levels occur because of the presence of residual radioactive materials from a designated inactive processing site. The numerical criteria are outlined in Table 1.

Table 1. EPA interim standards for remedial action cleanup of open lands and structures

Type of radiation	Remedial action (RA) standard
External gamma radiation (EGR) in dwellings	RA required if EGR greater than 0.02 mR/hr above background
Radon daughter concentration (RDC) in dwellings	RA required if RDC greater than 0.015 WL including background (annual average)
Ra-226 concentration on open lands	RA required if Ra-226 concentration greater than 5 pCi/gm

Legend
mR/hr = milliroentgen per hour
WL = working level, or RDC per liter of air that results in the eventual emission of 1.3×10^5 MeV of alpha energy
pCi/gm = picocuries per gram

The EPA has also proposed standards governing the disposal of residual radioactive materials from inactive uranium processing sites (46 FR 2556-2563, January 9, 1981). These standards (Table 2) place limits on the amounts of certain elements and substances that may be released from the final disposal site. In addition, the disposal of the radioactive material must be done in such a manner that there is a reasonable expectation that the limits in the proposed standards will be maintained for at least 1000 years. The standards impose the following limits:

1. The average annual release of radon-222 at the surface of the site is limited to values less than or equal to 2 picocuries/meter^2-second plus the radon emission expected from the materials covering the tailings.

2. Concentrations of the elements in underground sources of drinking water are limited to the values in Table 2. Material released from a disposal site is neither to cause the concentrations of the specified elements in underground drinking water to exceed the levels in Table 2 nor to result in any increase in their concentrations in water that exceeded those levels before the remedial actions for causes other than residual radioactive material. These limitations apply to underground drinking water beyond 1.0 kilometer (3300 feet) from a disposal site that was a processing site and beyond 0.1 kilometer (330 feet) from a new disposal site.

3. Materials released from disposal sites should not cause an increase in the concentration of any toxic substance in any surface waters. In general, "surface waters" means any bodies of water on the earth's surface that the public may traverse or enter, or from which food may be taken.

Under exceptional circumstances when the EPA standards cannot be fully met, the DOE may select and perform remedial actions that come as close to meeting the EPA standard to which the exception applies as is reasonable. NRC concurrence will be obtained on an individual basis.

4.2 NRC Licensing

The NRC has not issued and does not intend to issue regulations that apply to the cleanup and disposal of residual radioactive materials at the UMTRCA Title I inactive uranium processing sites. In conformance with UMTRCA, NRC concurrence in proposed remedial actions and determinations as to the licensability of disposal sites for such materials will be to ensure compliance with the final version of the EPA Standards discussed in Section 4.1. On October 3, 1980, however, the NRC did issue regulations governing disposal of tailings from active uranium milling operations. These regulations (45 FR 65533-65536) are not applicable to UMTRAP remedial actions, but do contain technical criteria, primarily in the form of performance objectives, for the disposal of uranium mill tailings. Although they will not be applied by the NRC to the inactive sites, the NRC criteria embody considerations that are relevant to the evaluation of remedial action alternatives for an UMTRCA Title 1 inactive site.

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Table 2. EPA proposed standards for tailings disposal

ELEMENT CONCENTRATION IN SOURCES OF UNDERGROUND DRINKING WATER		
Element	Maximum permissible concentration in ground water	
Arsenic	0.05	milligram/liter
Barium	1.0	milligram/liter
Cadmium	0.01	milligram/liter
Chromium	0.05	milligram/liter
Lead	0.05	milligram/liter
Mercury	0.002	milligram/liter
Molybdenum	0.05	milligram/liter
Nitrate nitrogen	10.0	milligram/liter
Selenium	0.01	milligram/liter
Silver	0.05	milligram/liter
Combined radium-226 and radium-228	5.0	pCi/liter
Gross alpha particle activity including radium-226 (but excluding radon and uranium)	15.0	pCi/liter
Uranium	10.0	pCi/liter

RADON FLUX LIMIT FROM DISPOSAL SITE		
Maximum permissible radon flux emitted from residual radioactive materials at the disposal site	2	pCi/m^2-second (annual average)

Legend
pCi = picocuries
m^2 = square meter

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4.3 Factors Affecting Evaluation

Many factors must be considered in the evaluation process used for determining the preferred option, most of which directly relate to meeting the EPA standards. These factors may be classified in four principal groups, although some factors appear in more than one group. The evaluation of the effects of these factors is a major element in the analytic process to be included in the environmental assessment (EA) planned for the Shiprock remedial actions. The use of the evaluation factors at this early stage contributes to a more rational choice of the remedial action concept that seems to be the most feasible.

The four groups of factors that will be used to evaluate each option are the following:

1. Physical and technical factors. This group of factors concerns the ability of the potential disposal site to resist natural processes that might disturb the tailings after the remedial actions are completed. The factors in this group evaluate the vulnerability of the site to natural phenomena (seismic disturbance, floods, land or rock slides, avalanches, extreme erosion, mine subsidence, etc.). Among the factors are the characteristics of the hydraulic system in the area that includes the disposal site, e.g. depth of ground-water table, proximity to aquifers and streams, ground-water flow rates, quality of ground water, and potential for flowing artesian wells; the chemical and physical characteristics of the surrounding soils and rocks; the type and condition of underlying strata and bedrock; the climate at the site; and the topography of the area.

2. Environmental factors. In this group the factors involve such things as the potential health effects from the transportation and disposal of tailings; the noise generated by the remedial actions; the short- and long-term effects on flora and fauna in the area; and the effects on potable ground water.

3. Economic factors. These factors relate to the economics of decontamination, transportation, and stabilization. They include costs for site acquisition, rights of way, construction, transportation, impoundment system, cover materials, etc.

4. Social factors. These factors include the present and forecasted population density surrounding the potential disposal site; the potential use of the site for other activities (mineral recovery, agriculture, industrial development, wildlife refuge, transportation corridor, etc.); and the effects on the social and economic well-being of the affected population.

5. PROPOSED REMEDIAL ACTION

The major alternatives that might be considered at the Shiprock site are to take no action, to stabilize the tailings at their present location, and to transport the tailings to a new disposal site and decontaminate the former processing site. The DOE proposes to stabilize the tailings in place, which is to say to use the present Shiprock site as the final disposal site.

The remedial action would begin with decontamination of any vicinity properties identified as being contaminated with residual radioactive material from the Shiprock site and included in the DOE's list of vicinity properties. All offsite contaminated material would be consolidated at the Shiprock site.

In order to protect the site from erosion due to future changes in the river bed, it may be necessary to move part of the north pile some 250-300 feet back from the edge of the river bluff. It would then be combined with the south pile to create one pile of approximately uniform thickness. An earth and rock cover over the pile would control the infiltration of rainwater and the emission of radon.

The earth and rock materials needed for the cover would be obtained from a pit dug into the underlying Mancos Shale on the southwest side of the present south pile. This pit would then be filled with unusable borrow materials to above the groundwater level and then with tailings and other contaminated material from the north pile. All tailings would then be graded smooth. The top of the resulting final pile would have 1-1/2 percent slopes for drainage of rainwater, and the slope of its edges would be approximately 5:1, horizontal to vertical.

The cover over the tailings would be thick enough to reduce the radon emission to levels required by the final EPA standards. A representative design, one that would meet the proposed 2 pCi/m^2-s standard, would include a 1-foot layer of gravel directly over the tailings, then a 3-foot impermeable cap of clay, a 7-foot earth cover, and a 1-foot final cover for erosion protection. The final cover would consist of 4- to 12-inch diameter rock riprap on the 5:1 slopes and medium to coarse gravel on the 1-1/2 percent slopes. The riprap would extend out 10 to 20 feet from the toes of the slopes. The gravel would be obtained by screening alluvial material overlying the Mancos Shale. The clay cap would consist of recompacted Mancos Shale. The earth layer would be clayey silt and silty sand from the excavated alluvial layer. The riprap for the outside slopes is the only material not available on-site in the required quantities; it would be obtained from off-site sources.

If necessary, a slurry wall of cement and bentonite would be constructed around the tailings with its base in solid Mancos Shale. The wall would further isolate the tailings from ground water systems that now exist or that may develop in the future.

6. POSSIBLE ALTERNATIVE ACTIONS

Option 1: No action

In this option there would be no remedial action; the present situation would continue with no corrective action.

Option 2: Decontamination of the Shiprock site and transfer of all contaminated material to a new disposal site

In this option, the disposal site would be a site other than the present Shiprock millsite. The present site would be decontaminated and reclaimed. All tailings and contaminated materials, including those materials obtained in the cleanup of vicinity properties, would be moved to and stabilized at one of several locations discussed below.

Studies in 1976 and late 1980 identified a number of possible alternative disposal areas for the Shiprock tailings. The plains area immediately south of Shiprock appears to contain a number of sites that would be geotechnically and environmentally acceptable. There are also other areas that may also be geotechnically acceptable, but they involve the transportation of the tailings through Shiprock and over longer distances and would entail additional expense. These studies indicated that the current site may be geotechnically acceptable as the permanent disposal site and that its use would avoid environmental problems connected with the transportation of tailings.

The results of this study were presented to the Navajo Environmental Protectiom Commission and to several Navajo Chapters located in and near Shiprock. The Navajo Nation took no formal position in response to the study; however, informal responses from individual Navajos in meetings and from Chapter officials indicate support for stabilizing the tailings at the present site. The environmental impact of transportation of tailings and the need for allocating of new land for their disposal if the tailings were to be moved appeared to be the concerns that led to their preference for in-place stabilization.

Suboption 2A: Disposal at a Site South of Shiprock

There is an area of about 50 square miles south of the present site that appears to contain several locations suitable for tailings disposal (See Figure 5). In this suboption, a geological survey followed by geotechnical investigations would be needed to identify a specific disposal site. Agreement would have to be reached with the Navajo Nation on designating the particular location and on transferring control of that land to the DOE.

From the economic and environmental standpoints, the distance that tailings are moved should be minimized. One might find a suitable disposal location in the plains area within five miles of the present site; within that distance the use of a conveyor transportation system might be feasible or a special use road for truck transportation might be constructed. For longer distances, movement would be by truck on U.S. Highway 666.

At the selected site, the top soil along with a to-be-determined thickness of Mancos Shale would be excavated and used to cover the tailings and for cover and fill at the decontaminated Shiprock site. The tailings and contaminated materials would be deposited in the excavated volume.

Suboption 2B: Disposal in an Open Pit Coal Mine

There are a number of inactive open-pit coal mines in the vicinity of the Four Corners power plant (See Figure 5). These mines were dug 50 to 100 feet deep into the Fruitland Formation, which consists of shale interbedded with sandstone and coal.

The tailings would be deposited in one of these pits and then covered with the soil, shale, and sandstone previously taken out to uncover the coal. Some of this soil, shale, and sandstone could also be used for fill at the Shiprock site, the tailings trucks hauling the fill back on the return trip. Geotechnical studies would be needed to determine whether a liner to contain the tailings would be required.

There is already a dirt road south of the San Juan River between the Shiprock site and the mine area--a distance of about 20 miles. It might be preferable to upgrade this route to a two-lane paved road rather than to use U.S. Highway 550 for access to the mine. The use of Highway 550 would mean many trucks hauling tailings through Shiprock and over two crossings of the San Juan River, would increase the haul distance to about 26 miles, and could damage the roadbed and necessitate costly repairs.

Suboption 2C: Off-Reservation Disposal

The best site found that is completely off Indian land is about one mile northwest of the San Juan power plant (See Figure 5). It is on public land, and all mineral rights are owned by the government. The land is flat to gently sloping. It is underlain by Lewis Shale. Geotechnical studies would be needed to determine whether a liner under the tailings would be required.

The top soil along with a to-be-determined thickness of shale would be excavated and used to cover the tailings and for cover and for fill at the decontaminated Shiprock site. The tailings and contaminated materials would be deposited in the excavation and covered.

The tailings would be trucked through Shiprock, east along U.S. Highway 550, and then north to the power plant. An additional one-mile stretch of road from the power plant northwest to the disposal site would have to be paved. The total transportation distance would be about 21 miles. The heavy truck traffic involved in the move could cause damage to the roads and necessitate repairs.

Option 3 Reprocessing

None of the options mentioned so far, including the proposed action, includes reprocessing the tailings for the recovery of residual uranium and vanadium. Under the provisions of Public Law 95-604, an expression of interest in reprocessing was requested from the Navajo Nation, the owner of the tailings. Requests for expressions of interest were also sought by notices in the Federal Register, in the Commerce Business Daily, and in a public press release. There were a number of responses that indicated general interest, but no interest was expressed in the Shiprock tailings. The DOE has under way a program to assay the residual mineral values in these tailings and to study the economic feasibility of their recovery. However, the depressed state of the uranium market and the low concentrations of uranium and vanadium in these tailings indicated by early results from the assays make it improbable that there will be any interest in reprocessing the Shiprock tailings.

7. EVALUATION OF THE OPTIONS

This section contains an evaluation of the remedial action options described in Sections 5 and 6. These evaluations are compared in Table 3. It should be emphasized that the assessments are preliminary. The DOE does propose a particular action, stabilization in place, but there must be a more detailed analysis of that proposal reported in an environmental assessment. If it is shown that the DOE's now-proposed option has no significant impacts, then it can become the action to be carried out; if this cannot be clearly shown, an environmental impact statement will have to be prepared that analyzes and intercompares a spectrum of reasonable and available alternatives. The purpose of the evaluations that follow is to show why the DOE proposes stabilization in place instead of one of the other options.

The Proposed Action: Stabilization in Place

A study made in early 1982 indicates that it is probably possible to meet the EPA standards while stabilizing the tailings in-place. The only movement of tailings in this option is what would be required to move the tailings back from the bluff. (In the various suboptions of Option 3, all the tailings would have to be moved.) Moving the tailings back at least 200 feet from the bluff should eliminate the possibility of erosion of the river bluff into the tailings for more than a thousand years. This option would minimize the environmental problems associated with the disturbance of radioactive material during on-site work. However, the presence of water beneath the piles (believed to be residual water drained out of the tailings), of washes adjacent to the piles and leading to the river, and of 10 to 20 feet of fractured shale on top of a solid Mancos Shale base indicates that there may be a need for additional protection against the possibility that ground water would move through the tailings and carry contamination offsite. A slurry wall around part or all of the site would provide this additional protection.

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Table 3. Comparison of options

	Proposed action	Option 1	Option 2A	Option 2B	Option 2C
Movement of tailings:					
Amount (million tons)	1	0	3-5	3-5	3-5
How far?	250-300 ft		5 mi	20-26 mi	21 mi
Through Shiprock?	no		no	maybe	yes
Movement of cover material:					
Amount (million tons)	1	0	1-3	1-3	1-3
How far?	200 ft		source not determined		
Other:					
Kind of rock	Mancos shale	Mancos shale	Mancos shale	Fruitland formation	Lewis shale
Land control	Navajo	Navajo	Navajo	Navajo	Federal (BLM)
Meet EPA standards?	yes	no	yes	yes	yes
Cost (million 1982 dollars)	15-18	0	30-45	60-90	70-100

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The transportation of the soil and riprap needed to cover the tailings and of the materials needed for the slurry wall, if required, would also have some environmental impacts. However, the total amount of material to be moved will be far less than in any of the suboptions of Option 2, where the tailings are moved to another site.

The basic disadvantage of this option is that the tailings would remain near the community of Shiprock and the San Juan River. Nevertheless, a program of remedial action that complies with the EPA standards should eliminate concern about this disadvantage.

The cost of this option is estimated to be about $15 million. If the slurry wall were included, this cost would increase by about $3 million. Either cost is far less than the costs estimated for the Option 2 suboptions.

Option 1: No action

This option would involve no remedial actions and no environmental impacts from those actions; however, radon exhalation and external gamma 17diation at the Shiprock tailings piles currently exceed the proposed EPA standards, and Public Law 95-604 requires the completed remedial action to be in compliance with the EPA standards. Thus this option is unacceptable.

Option 2: Decontamination of the Shiprock Site and Transfer of the Tailings to a New Disposal Site

A specific site would have to be selected and investigated before there can be a detailed evaluation of this option. However, an evaluation in general terms should provide enough information to let it be compared with the proposed action.

Suboption 2A: South of the Shiprock Site

The area south of Shiprock is sparsely populated and has very little vegetation. It is, however, used for grazing, it could conceivably become suitable for irrigation if water should become available, and the people of the Shiprock community have said they do not want to relinquish any land in the area for use as a disposal site.

Investigations of the Shiprock site have indicated that there are large volumes of gravel and fractured shale beneath the tailings contaminated to levels exceeding the EPA standards. It appears that three to five million tons of this material would have to be moved from the present site before it could be released for unrestricted use. One to three million tons of fill would have to be hauled back to the Shiprock site to fill the resulting hole. The excavation and transportation of such large volumes of material would create greater environmental impacts both in the Shiprock vicinity and along the transportation routes than would the option of stabilization in place. If a conveyor or special use road could be used, the impacts of transportation would be less than those in Suboptions 2B and 2C described below.

If transportation is by 20-ton truck, 150,000 truckloads would be needed to move the expected three million tons of material. This would be one truckload every five minutes, 10 hours per day, 365 days per year for almost three and one-half years. If five million tons were to be moved, 250,000 truckloads and almost six years would be required.

The cost of this suboption is estimated to be $30 to $45 million, depending on the amount of material to be moved and assuming a haul distance of about five miles.

Suboption 2B Disposal in an Open-Pit Coal Mine

The use of an open-pit coal mine would have the advantages that the land has already been disrupted and that a below-grade disposal pit is already available.

The Fruitland Formation in which the tailings would be deposited in this option would, in general, not constitute as impermeable a containment medium as would be expected with Mancos Shale (as found at the Shiprock and the Suboption 2A sites) or with Lewis Shale (as found at the Suboption 2C site). Investigations would be needed to determine whether a containment liner would be required to ensure compliance with the EPA standard on water contamination.

The excavation and fill requirements at the present site and, hence, numbers of truckloads would be the same for this option as for Suboption 2A. However, because of the 20 mile haul distance in this option, a far larger number of trucks would be required if the same time schedule were to be met. If these trucks were to use Highway 550, they would constitute both a considerable addition to traffic in the town of Shiprock and a possible source of damage to those roads. The use of the road south of the river--upgraded by paving--should not create significant traffic problems. There are houses along this dirt road, however, and environmental impacts would be greater than in Suboption 2A.

The cost of this suboption is estimated to be $60 to $90 million, depending on the amount of material to be moved.

Suboption 2C: Off-Reservation Disposal

This suboption provides for disposal on government-owned land near but off the reservation.

Geotechnical investigations would have to be performed to verify the suitability of the location as a disposal site. The terrain is flat to gently sloping and is underlain by Lewis Shale, which typically has the properties desired for tailings disposal. The nearest buildings are those at the San Juan power plant.

In this suboption, operations at the Shiprock site and the disposal site and the number of truckloads of material to be moved would be essentially the same as in Suboption 2A. However, the transportation route would be through Shiprock and along U.S. Highway 550 to the power plant exit. Use of this route would have the same sort of environmental impacts as Suboption 2B if Highway 550 were to be used, but smaller ones because of the shorter length of highway that would be used.

The cost of this suboption is estimated to be $70 to $100 million, depending on the amount of material to be moved. This estimate assumes that the cost of repairing damage to this route would be greater than that of paving the two-lane road in Suboption 2B.

Option 3: Reprocessing

As indicated above, there is little prospect of commercial interest in reporocessing the Shiprock tailings.

8. PROPOSED OPTION

As noted in Section 5, the DOE proposes stabilization in place at this time as the remedial action to be taken at the Shiprock tailings piles. Although the tailings would remain near a populated area and a river, the EPA standards can probably be met and the environmental impacts and the cost of remedial actions would be small compared to other options. This option will be treated as the proposed action in the environmental assessment to be prepared for the remedial action on the Shiprock tailings piles.

9. SCHEDULE AND COST ESTIMATE

The schedule for the remedial actions at the Shiprock site is shown in Figure 6. In allowing three years for completion of the remedial actions, it is assumed stabilization in place is the action decided on.

The preliminary cost estimate is that stabilization in place would cost $15 to $18 million in 1982 dollars. The cost of decontaminating any vicinity properties that may be designated for cleanup has not been included. However, it is not expected that more than about 15 properties will be designated, and the cost of cleaning these up should be small compared to the cost of on-site stabilization. Of the total cost, about 75% would be for the remedial actions themselves; the remaining 25% would be the cost of environmental analysis, engineering, and maintenance and surveillance activities.

10. FUTURE ACTIVITIES

This Remedial Action Concept Paper for Shiprock is only a preliminary plan of action. The remainder of this paper describes the major activities still to be performed.

10.1 Designation of Vicinity Properties

DOE will conduct a ground-level radiological survey of the Shiprock area during 1982. Any properties in the vicinity found to be contaminated with residual radioactive material from the Shiprock site will be included for cleanup as part of Shiprock remedial actions.

10.2 Preparation of an EA

The DOE is preparing an environmental assessment (EA) for the Shiprock site because all the presently available information indicates that the most environmentally suitable concept for remedial action is stabilization in place. If the EA confirms that this remedial action concept will not produce significant impacts, it will be possible to proceed sooner on the remedial action work. If, however, the EA does not conclusively support the acceptability of stabilization in place, an environmental impact statement (EIS) will be required to determine the most appropriate remedial action. The EA will be prepared for the DOE by the Sandia National Laboratories with the assistance of Dames and Moore. Much of the data required for preparation of the EA was obtained by Dames and Moore during a study of the feasibility of in-place stabilization that was completed in April 1982. The EA will also address the remedial actions to be performed at any vicinity properties that may be found.

According to the applicable Council on Environmental Quality regulations (40 CFR 1508.9), an environmental assessment is a concise public document whose principal purpose is to determine whether an environmental impact statement is necessary or a finding of no significant impact can be made for a proposed project. The principal differences between EAs and EISs are in the length of the two kinds of documents and in their treatments of alternatives. The former are generally no longer than 30 to 40 pages, exclusive of appendices; the latter are limited by regulation to 150 pages, exclusive of appendices (except in the case of very complex EISs, which can be 300 pages long). EISs are required to analyze a full spectrum of reasonable alternatives; an EA considers the proposed action in detail and other options for action in only enough detail to indicate why they were not proposed.

10.3 Site Acquisition

All options except Suboption 2C involve disposal sites on the Navajo Reservation. In those cases DOE would assume control of the site as specified in the cooperative agreement. In Suboption 2C disposal would be on public land.

10.4 Remedial Action Plan

A remedial action plan (RAP) consisting of conceptual engineering designs, performance standards, schedules, and cost estimates will be prepared after the final remedial action concept has been selected. The RAP must be concurred in by the NRC as directed by the UMTRCA and by the Navajo Nation in conformance with the cooperative agreement between the Navajo Nation and the DOE.

10.5 Engineering

A technical assistance contractor (TAC), Jacobs Engineering, has been selected by the DOE to assist the UMTRA Project Office in planning and managing remedial actions. The DOE will select a remedial action contractor (RAC) to provide architect-engineer and construction-management services by the end of 1982.

The TAC will prepare the RAP for the DOE. After it has been issued and concurred in, the RAC will prepare detailed engineering designs and issue subcontracts for carrying out the remedial actions. These designs will be based on the final EPA standards, information developed in the UMTRAP technology development program, the EA, and the RAP.

The TAC will also be responsible for the maintenance and surveillance of the final disposal site when the remedial actions have been completed.

10.6 Site Remedial Action

A schedule of the remedial action process at Shiprock is shown in Figure 6. It is expected that remedial actions will be started in 1984.

10.7 Certification

During the remedial work and following its completion, radiological surveys will be performed to verify the effectiveness of the remedial actions and to ensure that the site meets the EPA standards and NRC licensing requirements. Certification will be carried out under the direction of the DOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness (ASEP).

10.8 Maintenance and Surveillance

Maintenance and monitoring procedures will be implemented by the DOE at the disposal site to ensure that the site remains environmentally sound. Conditions at the site must be maintained so that it continues to be in compliance with EPA standards and NRC license conditions.

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11. RELATED DOCUMENTS

The following is a list of documents that relate to the Shiprock remedial actions.

1. Ford, Bacon & Davis Utah Inc., March 1977. Engineering Assessment of Inactive Uranium Mill tailings, Shiprock Site, Shiprock, New Mexico, FBDU 130-1. Salt Lake City, Utah.

2. Ford, Bacon & Davis Utah Inc., July 1981. Engineering Assessment of Inactive Uranium Mill Tailings, Shiprock Site, Shiprock, New Mexico, FBDU 360-02, Salt Lake City. Utah.

3. Oak Ridge National Laboratory, December 1979. Assessment of the Radiological Impact of the Inactive Uranium-Mill Tailings at Shiprock, New Mexico, ORNL-5447. Oak Ridge, Tennessee.

4. National Environmental Research Center-Las Vegas, EPA, December 1972. State Summary Report for Radiation Surveys: Shiprock, New Mexico, EPA-ORP-LV. Las Vegas, Nevada.

5. Office of Radiation Programs - Las Vegas Facility, EPA, August 1978. Estimated Average Annual Radon-222 Concentrations Around the Former Uranium Mill Site in Shiprock, New Mexico, ORP/LV-78-7. Las Vegas, Nevada.

6. Energy Measurements Group, EG&G, December 1980. An Aerial Radiological Survey of the Shiprock, New Mexico Uranium Mill Tailings Site. EP-U-001. Las Vegas, Nevada.

7. Politech Corporation, September 1980. The Navajo Nation, (Shiprock, New Mexico; Mexican Hat , Utah; Monument Valley, Arizona; Tuba City, Arizona) Site Information Handbook, DOC No. 62-2469. Austin, Texas.

8. Politech Corporation, October 1979. New Mexico State Information Handbook, Uranium Mill Tailings Remedial Action Program, Contract No. EY-76-C-06-1857. Austin, Texas.

9. Dames & Moore, April 1982. Draft Feasibility Evaluation, On-Site Stabilization of Uranium Mill Tailings, Shiprock, New Mexico, UMTRA-DOE/ALO-xxx. Golden, Colorado.

10. Letter, J. W. McKiernan (Sandia National Laboratories) to R. H. Campbell (DOE/ALO), December, 1980. Alternative Disposal Sites for Shiprock Tailings. Albuquerque, New Mexico.

11. Sandia National Laboratories, April 1981. Contents of Environmental Assessments Prepared for the Uranium Mill Tailings Remedial Action Project, UMTRA-DOE/ALO-9. Albuquerque, New Mexico.

12. United States Environmental Protection Agency, December 1980. Draft Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites, EPA 520/4-80-011. Washington, D.C.

13. United States Environmental Protection Agency, January 1981. Proposed Disposal Standards for Inactive Uranium Processing Sites; Proposed Rule and Extension of Comment Period, 46 Federal Register 2556-2563. Washington, D.C.

14. Nuclear Regulatory Commission, October 1980. Uranium Mill Licensing Requirements, 45 Federal Register 65521-65538. Washington, D.C.

15. Office of Nuclear Material Safety and Safeguards, September 1980. Final Generic Environmental Impact Statement on Uranium Milling, NUREG-0706. Washington, D.C.

16. Hans, Joseph M., Jr., et al., 1981. Papers presented at the International Conference on Radiation Hazards in Mining: Control, Measurement, and Medical Aspects, October 4-9, 1981, Colorado School of Mines. Proceedings published by the Society of Mining Engineers, New York, N.Y.

    a. The Use of Earth Moving and Ancillary Equipment to Decontaminate a Uranium Millsite.

    b. Whole Body Gamma Ray Exposures to Personnel Decontaminating a Uranium Millsite.

    c. The Planning and Management Aspects of Uranium Millsite Decontamination Activities.

    d. Gamma Exposure Rate Reduction and Residual Radium-226 Concentrations Resulting from Decontamination Activities Conducted at the Former Uranium Millsite in Shiprock, New Mexico.

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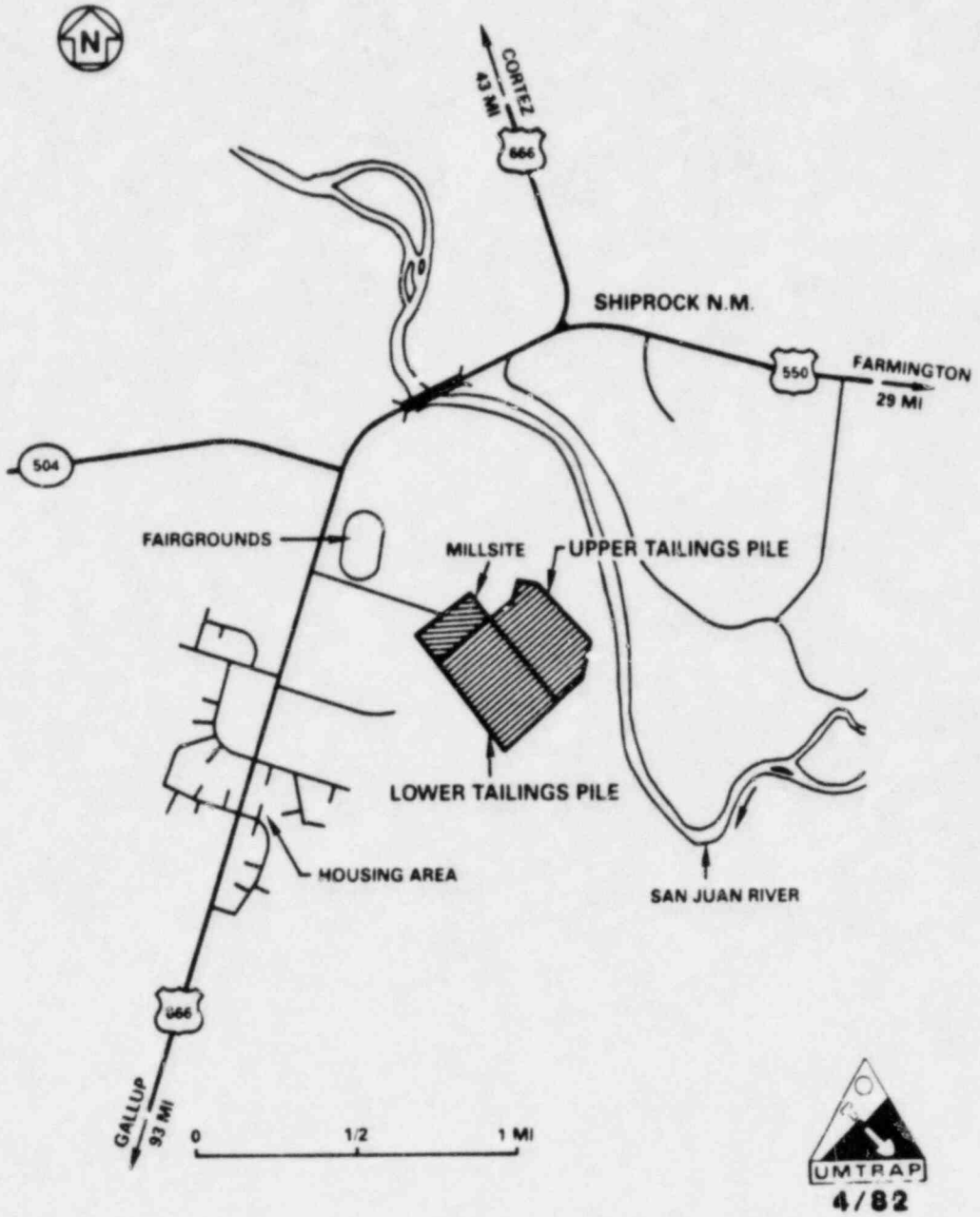
Figure 1 Map of Shiprock Area



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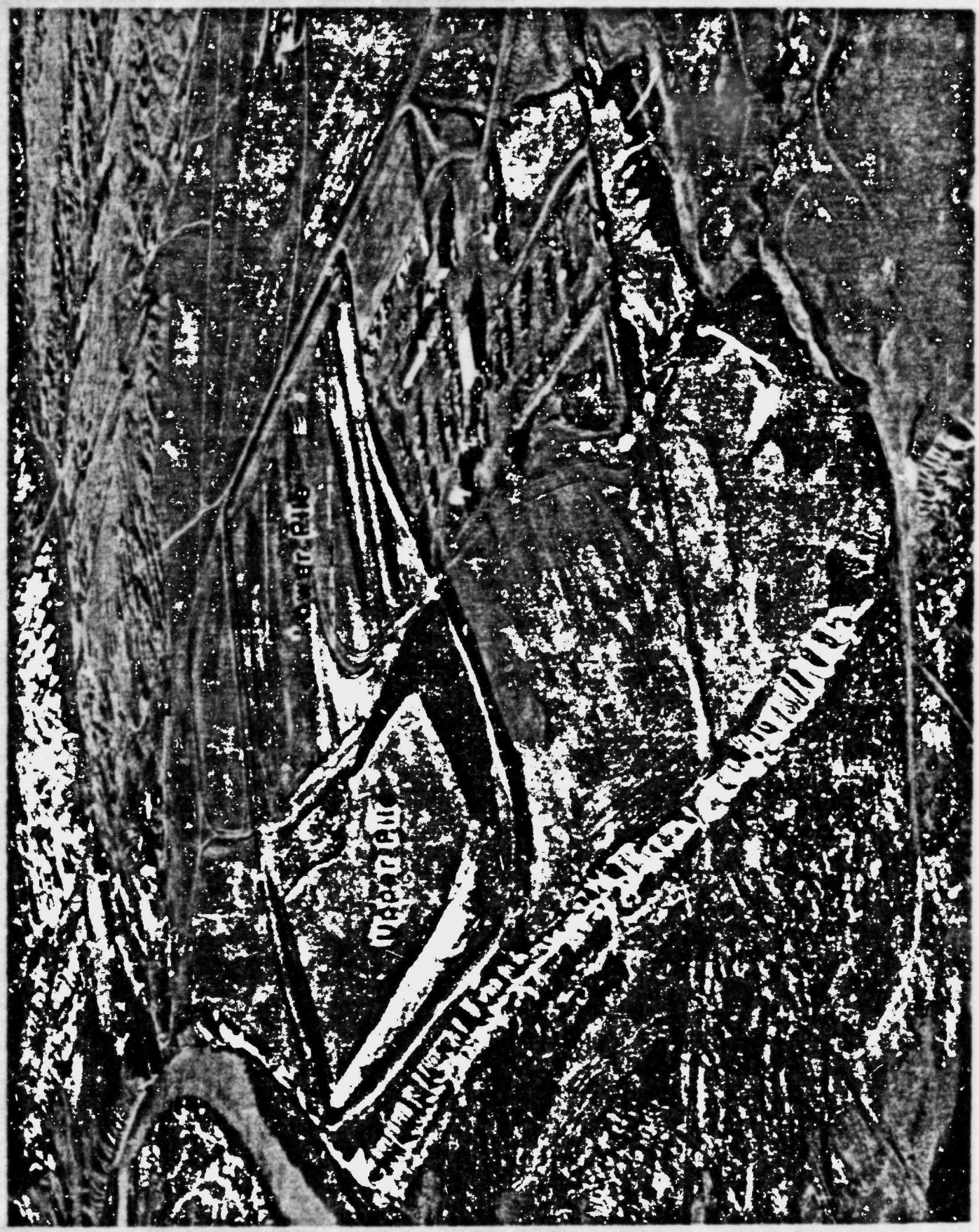

Figure 2. Photograph of Shiprock Site.

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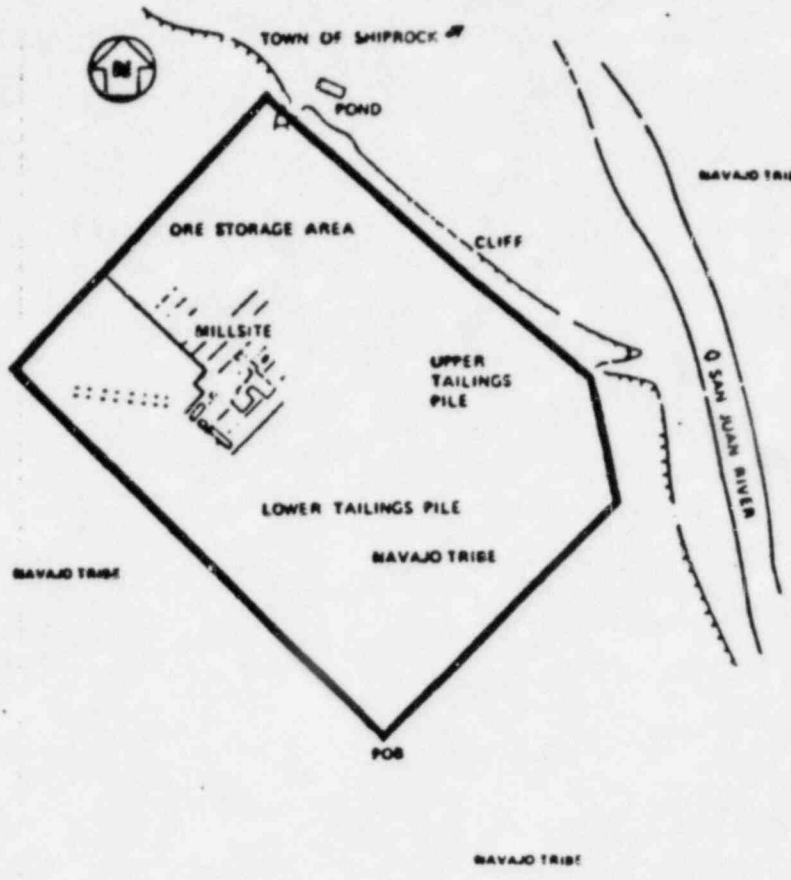

A parcel of land located in the southwest quarter of the northwest quarter and the northwest quarter of the southwest quarter of section thirty-one in township thirty north of range seventeen west; and in the northeast quarter, southeast quarter of the northwest quarter and the north half of the southeast quarter and the southeast quarter of the southeast quarter of section thirty-six in township thirty north of range eighteen west of the New Mexico Principal Meridian in San Juan County, New Mexico, containing 143.60 acres, more or less, more particularly described as beginning as a point which lies N. 43°52'30" W., 1355.3 feet from the southeast corner of section 36, T. 30 N., R. 18 W., N.M.P.M. and running thence N. 45°00' W., 2925 feet; thence N. 45°00' E., 1993.71 feet: thence S. 52°35' E., 2376.3 feet; thence S. 7°47'53" E., 715 feet: thence S. 45°00' W., 1875 feet to the point of beginning. Located at Shiprock, New Mexico.

Figure 3. Legal Description of Shiprock Site.

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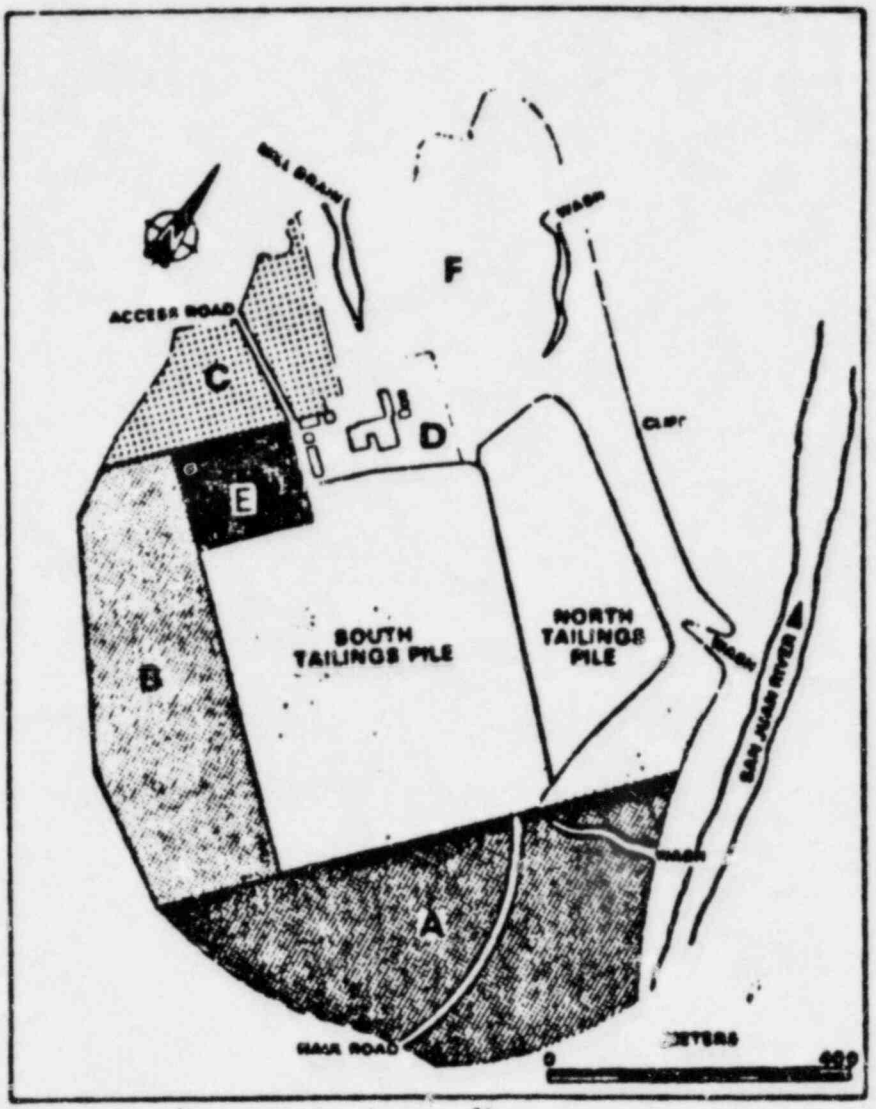

Figure 4. Major Areas of Shiprock Site.

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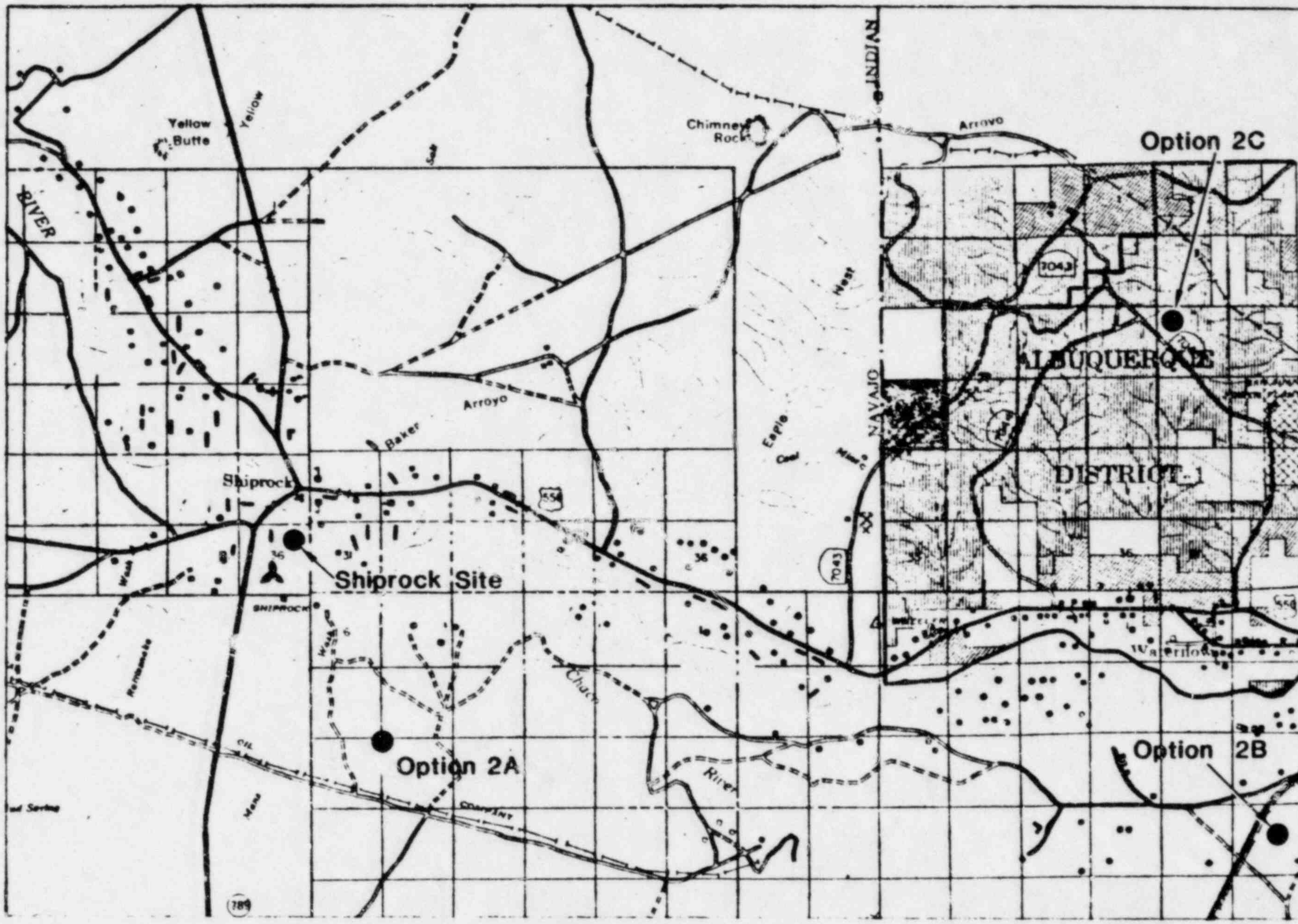

Figure 5. Location of Potential Disposal Sites.

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Figure 6

REMEDIAL ACTION SCHEDULE FOR SHIPROCK TAILINGS SITE